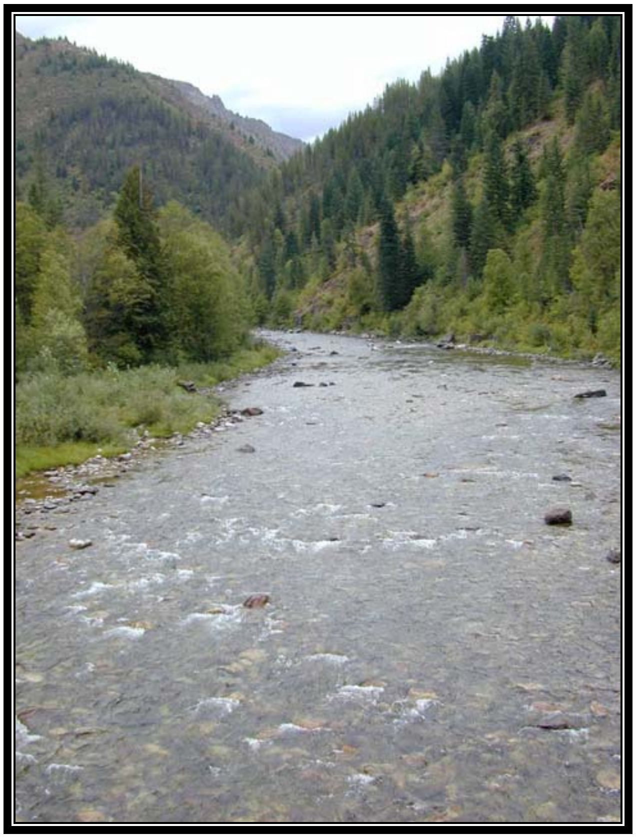
Upper North Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads



Department of Environmental Quality
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2. Subbasin Assessment – Water Quality Concerns and Status

This section discusses the reasons that stream segments were placed on the 303(d) list, describes the applicable water quality standards, and presents available water quality data that relate to the water quality status.

2.1 Water Quality Limited Segments Occurring in the Subbasin

Within the UNFCRS, 18 tributary stream segments were placed on the state of Idaho's 1996 303(d) list because of concerns that sediment may be impacting the streams' beneficial uses (Table 4). One of these streams, Osier Creek, was also listed for temperature concerns. One other stream, Sneak Creek, was listed for concerns about channel stability affecting beneficial uses. Figure 9 shows the distribution of the listed water bodies within the UNFCRS. Appendix 1 shows the correlation between the water bodies assessed and the newer "assessment units" that the state of Idaho and USEPA are currently using to track water quality limited waters. The 1996 303(d) list was a carryover of a 1994 list prepared in large part by the USEPA under court order. All of the water bodies were retained on Idaho's 1998 303(d) list (DEQ 1999) for lack of any data or assessment to the contrary.

Flow and habitat alteration are also identified on the 303(d) list as potentially impairing beneficial uses of Osier Creek. The USEPA does not believe that flow alteration (or lack of flow) or habitat alteration are pollutants as defined by CWA Section 502(6). Since TMDLs are required to be established only for water bodies impaired by identifiable pollutants, further assessment of Osier Creek for habitat or flow alteration was not conducted.

Beneficial uses for all of the 303(d) listed water bodies are cold water aquatic life and salmonid spawning. The salmonid species of particular interest are bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki*). The *North Fork Clearwater River Basin Bull Trout Problem Assessment* (Clearwater Basin Bull Trout Technical Advisory Committee 1998) identifies watersheds containing the following 303(d) listed streams in the UNFCRS as moderate or high priority for bull trout recovery: Middle, Gravey, Cougar, Grizzly, and Cold Springs Creeks. The USEPA designated Cold Springs, Cool, Cougar, Gravey, Grizzly, Laundry, Marten, Middle, Osier, Sugar, and Swamp Creeks as streams protected for bull trout spawning and rearing (40 CFR Part 131.33(a)(2)). The USEPA rule establishes a maximum weekly maximum temperature (MWMT) criterion of 10 ^{o}C (50 ^{o}F) for the months of June, July, August, and September for the protection of bull trout spawning and juvenile rearing in natal streams (40 CFR Part 131.33(a)(1)). Most of the 303(d) listed streams have populations of westslope cutthroat trout. The spawning season for cutthroat is April through July. This spawning season is the general spawning season for the species – specific spawning seasons may vary by location and elevation and are addressed as needed for each stream 303(d) listed as temperature limited.

This subbasin assessment addresses the question of whether the pollutants identified on the 303(d) list are of a nature and degree that the beneficial uses are not being fully supported in the water body.

Table 4. 303(d) listed water bodies in the UNFCRS.

Stream Name	Boundaries[1]	WQL Seg. No.[2]	Channel Type[3]	Stream Miles	Pollutant[4]
Sneak Creek	HW to NF Clearwater	5178	B	3.5	Channel Stability
Tumble Creek	HW to Washington	5200	B	4.6	Sediment
Orogrande Creek	HW to NF Clearwater	3215	B	19.5	Sediment
Tamarack Creek	HW to Orogrande	5193	B	3.9	Sediment
Sylvan Creek	HW to French	5192	B	4.3	Sediment
Hem Creek	HW to Sylvan	5093	B	5.0	Sediment
Middle Creek	HW to Weitas	5123	B	13.3	Sediment
Marten Creek	HW to Gravey	5119	B	4.5	Sediment
Gravey Creek	HW to Cayuse	3229	A	9.0	Sediment
China Creek	HW to Osier	5040	A	4.9	Sediment
Sugar Creek	HW to Swamp	5189	B	4.0	Sediment
Swamp Creek	HW to Osier	5190	B	5.4	Sediment
Osier Creek	HW to Moose	3225	A & B	8.1	Sediment, Temperature
Laundry Creek	HW to Osier	5104	A	4.4	Sediment
Deception Gulch	HW to NF Clearwater	5059	B	4.7	Sediment
Cold Springs Creek	HW to NF Clearwater	5045	A	4.8	Sediment
Cool Creek	HW to Cold Springs	5047	A	3.3	Sediment
Grizzly Creek	HW to Quartz	5088	A	4.5	Sediment
Cougar Creek	HW to Quartz	5049	A	3.7	Sediment

[1] HW = Headwaters, NF = North Fork
[2]WQL Seq No. = Water Quality Limited Segment Number
[3]A and B are Rosgen channel types (Rosgen 1994)
[4]Sed=Sediment; Temp=Temperature

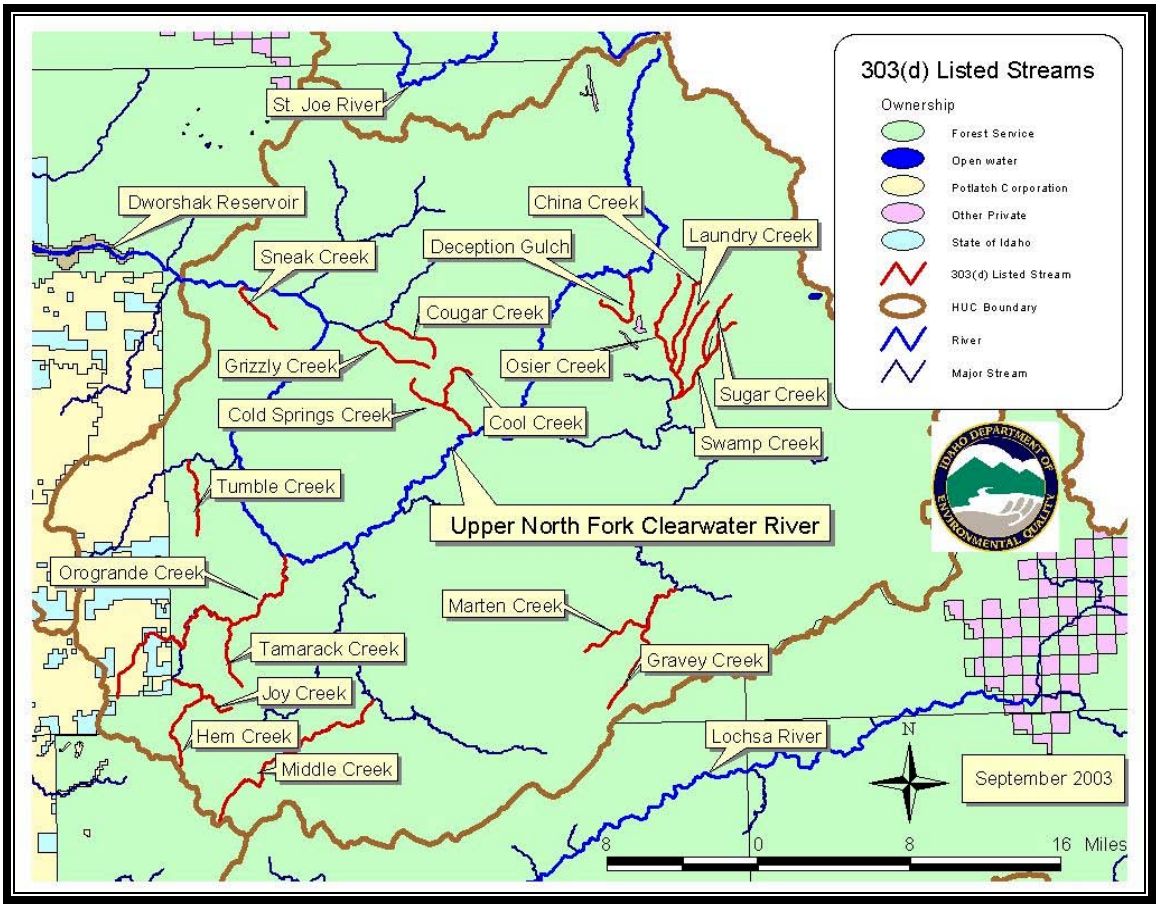

Figure 9. 303(d) Listed Water Bodies of the UNFCRS

2.2 Applicable Water Quality Standards

Application of the Idaho water quality standards depends on understanding the beneficial uses for which any give stream should be protected and the water quality standards in the Idaho code set to protect those beneficial uses. This section discusses the beneficial uses of the 303(d) listed streams in the UNFCRS and identifies the standards that must be met to protect those uses.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and "presumed" uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Specifically, the beneficial use of primary concern in the UNFCRS is the cold water aquatic life use and the subcategory of salmonid spawning, defined as follows (IDAPA 58.01.02.100.02):

> cold water aquatic life: waters which are suitable or intended to be made suitable for protection and maintenance of viable communities of aquatic organisms and populations of significant aquatic species which have optimal growing temperatures below eighteen (18) degrees C.

and

> salmonid spawning: waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes.

All water bodies in the UNFCRS considered in this assessment are assumed to "provide or could provide a habitat for active self-propagating populations of salmonid fishes." The data presented below support this assumption.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water body could support salmonid spawning, but salmonid spawning is not yet occurring.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include things like aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses).

Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water aquatic life is not found to be an existing use, an use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Sediment Water Quality Standards

The Idaho general surface water quality criterion for sediment (IDAPA 58.01.02.200.08) says:

> Sediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350.02.b. [Subsection 350.02.b. describes non-point source restrictions when water quality criteria are not being met, but does not add any specific sediment criteria.]
>
> Section 250.02.d specifies that "Turbidity … shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days."

Temperature Water Quality Standards

The Idaho general surface water quality criteria for temperature are shown in Table 5. For cold water aquatic life (IDAPA 158.01.02.250.02.b), "water temperatures shall be twenty-two (22 ^{o}C) degrees Celsius or less with a maximum daily average of no greater than nineteen (19 ^{o}C) degrees Celsius." For salmonid spawning (IDAPA 58.01.02.250.02.e.ii), "water temperatures shall be thirteen (13 ^{o}C) degrees Celsius or less with a maximum daily average no greater than nine (9 ^{o}C) degrees Celsius." For bull trout (IDAPA 58.01.02.250.02.f), "water temperatures shall not exceed twelve degrees Celsius (12 ^{o}C) daily average during June, July and August for juvenile bull trout rearing, and nine degrees Celsius (9 ^{o}C) daily average during September and October for bull trout spawning."

In addition to the Idaho water quality criteria, for streams that have been designated by the USEPA as protected for bull trout spawning and rearing, "a temperature criterion of 10 ^{o}C (50 ^{o}F) expressed as an average of daily maximum temperatures over a seven-day period applies…during the months of June, July, August, and September" (40 CFR Part 131.33(a)).

As a point of clarification of our use of the standards in the UNFCRS, for those water bodies designated by the USEPA as protected for bull trout, we use the federally promulgated bull trout temperature criterion because it is the most limiting. For all the other water bodies, we use the salmonid spawning criteria for cutthroat, rainbow, and brook trout, in that order, depending on the species present.

Table 5. Idaho's water temperature criteria for beneficial uses in the UNFCRS.

Beneficial Use	IDAPA 58.01.02	Maximum Water Temp.	Daily Average Water Temp.	Effective Time Period
Cold Water Aquatic Life	250.02.b	≤22 °C (71.6 °F)	≤19 °C (66.2 °F)	Year Round
Salmonid Spawning	250.02.e.ii	≤13 °C (55.4 °F)	≤9 °C (48.2 °F)	Spawning and Incubation
Brook Trout Spawning	Specific to UNFCRS	≤13 °C (55.4 °F)	≤9 °C (48.2 °F)	Oct 1 – June 1
Cutthroat Spawning	Specific to UNFCRS	≤13 °C (55.4 °F)	≤9 °C (48.2 °F)	Apr 1 – Aug 1
Rainbow Spawning	Specific to UNFCRS	≤13 °C (55.4 °F)	≤9 °C (48.2 °F)	Jan 15 – July 15
Kokanee Spawning	Specific to UNFCRS	≤13 °C (55.4 °F)	≤9 °C (48.2 °F)	Aug 1 – June 1
Bull Trout Spawning	250.02.f		≤9 °C (48.2 °F)	Sept 1 – Oct 31
Bull Trout Rearing	250.02.f		≤12 °C (53.6 °F)	June 1 – Aug 31

For the purposes of measuring the state designated criteria, "the daily average shall be generated from a recording device with a minimum of six (6) evenly spaced measurements in a twenty-four (24) hour period" (IDAPA 58.01.02.250.02.f). "Exceeding the water quality temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth (90th) percentile of the seven (7) day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station." These two standards do not apply to the federally promulgated bull trout streams or temperature criteria.

2.3 Summary and Analysis of Existing Water Quality Data

This section presents the various data sets used to evaluate water quality status compared with the state and federal sediment and temperature criteria. Sediment, in-stream temperature, biologic assessment, fish data, habitat data, and data gaps are discussed.

Flow Characteristics

The UNFCR flows almost 74 miles from its headwaters to where it empties into Dworshak Reservoir. The USGS calculates the mean annual flow for the UNFCR from 1967 to present at its Canyon Ranger Station just upstream from the reservoir to be 3,511 cubic feet per second (Brennan et al. 1999). Figures 2-9 and 2-10 in Appendix 2 show flow for 1998-99, mean daily flow for the period of record, and the daily flow for the period of record. Flow has ranged from a daily mean of 34,200 cubic feet per second on November 30, 1995, to 252 cubic feet per second on December 5, 1972. Peak flows generally occurred during spring run-off between April 18 and June 17 for the period of record, with May 23 as the median date for peak flow. The extreme peak flows shown on Appendix 2, Figure 2-10 represent rain-on-snow events. Low flows occur from August through mid- to late-winter. Low flows in late July and August, when air temperatures are high, can lead to high water temperatures.

Figures 2-11 through 2-15 in Appendix 2 show flow data collected by the CNF for five watersheds in the UNFCRS – the North Fork at Kelly Creek, Cold Springs Creek, Swamp Creek, Quartz Creek, and Gravey Creek. Since each site only has a few years of record, we have selected specific years to plot that show normal and extreme flows. Years 1983 and 1984 have records at the most sites. The same general trend can be seen in this data as in the USGS data. High runoff occurs from late April through early June, with some mid-winter peaks representing rain-on-snow events. Low flow begins in late July and August and continues on into late winter.

Water Column Data

The CNF has collected water column data at a number of sites around the forest, mostly associated with stream flow monitoring sites. We present the summary results for Cold Springs, Swamp, Gravey, Marten, and Quartz Creeks. All of these creeks except Quartz Creek are 303(d) listed for sediment. However, the Quartz Creek watershed contains Cougar and Grizzly Creeks that are 303(d) listed. The results of these data are presented in Appendix 2, Figures 2-16 through 2-20. The important thing to note about these data is that at no time do the peaks ever exceed 10 Jackson turbidity units (JTU) (JTUs are roughly equivalent to nephlometric turbidity units (NTUs) used in the state standards). The state water quality standard is a limit of 50 NTUs instantaneous.

Stream Temperature Data

Available stream temperature data collected by the CNF for the 303(d) listed streams are presented in Appendix 3, arranged alphabetically by stream. Stream temperature data are not available for Sugar, Marten, and Tumble Creeks. Both daily average and maximum weekly maximum temperatures are presented since the state standards are given in daily averages while the federal bull trout standard is based on the MWMT. The figures clearly show that the temperatures of these water bodies exceed the state and federal water quality standards for considerable parts of July and August.

Biological and Other Data

Available biological data consist of those collected by DEQ through BURP and extensive data collected by the CNF in their bio-physical assessment of streams.

Idaho's Water Body Assessment Guidance

Idaho rules (IDAPA 58.01.02.053) establish a procedure to determine whether a water body fully supports designated and existing beneficial uses, relying on physical, chemical, and biological parameters, as outlined in the *1996 Water Body Assessment Guidance* (DEQ, 1996). IDAPA 58.01.02.054 outlines procedures for identifying water quality limited waters that require TMDL development and establishes management restrictions that apply to water quality limited water bodies until TMDLs are developed.

The General Surface Water Quality Criteria (IDAPA 58.01.02.200) for Idaho set forth general guidance for surface water quality. The Surface Water Quality Criteria for Aquatic Use Designations (IDAPA 58.01.02.250) set forth specific numeric criteria to be met for particular beneficial uses. The WBAG sets forth a specific methodology whereby a water body is first assessed using the numeric criteria for a particular beneficial use, then identifies indices and methods for "narrative" assessments of pollutants for which numeric criteria do not apply or are not available. Sediment is the primary pollutant addressed by narrative means in the WBAG.

DEQ conducted BURP surveys on the water quality limited water bodies of the UNFCRS during July and August 1997 and in July 1998. The BURP surveys collected data on fish, macroinvertebrates, and stream habitat to determine whether a water body is supporting its designated beneficial uses. The WBAG results of the analysis of these BURP data for all of the 303(d) listed water bodies in the UNFCRS are presented in Table 6.

Idaho determines if its narrative sediment criteria are met by surveying streams to verify if viable communities of aquatic organisms are present and if evidence of beneficial uses exists in the stream. The BURP is a consistent scientific process used statewide for collecting this data. The WBAG evaluations of BURP data result in indices used to compare water quality with the standards to determine beneficial use support status. The macrobiotic index (MBI) is the primary index used to confirm beneficial use support status. An MBI score of 2.5 or less indicates not full support of beneficial uses, a score between 2.5 and 3.5 indicates that more information is needed to make a determination, and a score of 3.5 or greater indicates that the beneficial uses are fully supported. The state's procedure also specifies when to supplement the MBI with fish data, algal data, and habitat data in making water quality impairment determinations.

WBAG Plus

As a result of internal and external review of the 1996 WBAG (DEQ 1996), guidance from DEQ since that time indicates that support status determinations should be made in light of other biological, chemical, or habitat data, as well as agency reports with solid findings or conclusions. Therefore, we reviewed a considerable amount of other data and derived results to help us draw a conclusion of whether or not a given water body is actually of sufficient quality to support its beneficial uses.

In this chapter and in Chapter 3 we present a variety of data and modeled predictions specific to the water bodies on the 303(d) list. We use all these as well as other data to help evaluate whether water quality is meeting the state standards. Finally, in Chapter 5, we summarize, discuss, and draw our conclusions, water body-by-water body, about what these data mean with respect to water quality and support of beneficial uses.

Table 6. BURP/WBAG results for the 303(d) listed water bodies in the UNFCRS.

Water Body	Macro -biotic Index (MBI)	Salmonid Age Classes[1]	Temp °C/°F (instant-aneous)	Habitat Index (HI)	BURP % Fines	BURP CE[2] Rating	WBAG+ Rating[3]
China	3.81	4+j	13/55.4	106	13	30	NFS(t)
Cold Springs	5.00	4+j	15/59.0	107	8	40	NFS(t)
Cool	4.75	4+j	12/53.6	101	17	40	NFS(t)
Cougar	4.74	2+j	16/60.8	119	9.4	40	NFS(t)
Deception	5.86	4+j[4]	13/55.4	84	29	70	NFS(t&s)
Gravey (L)	5.15	3+j	6/42.8	95	17	50	NFS(t)
Gravey (U)	4.75	3+j	9/48.2	106	18	60	NFS(t)
Grizzly	5.12	2+j	12/53.6	95	28	40	NFS(t)
Hem 1997	5.34	2+j	16/60.8	105	21	35	FS
Hem 1998	5.55	3+j	15/59.0	111	21	20	FS
Laundry	4.83	3+j	8/46.4	121	8	25	NFS(t)
Marten	4.95	2+j	8/46.4	111	12	65	NFS(t)
Middle	4.96	3+j	11/51.8	105	24	25	NFS(t)
Orogrande (L)	5.08	3+j	18/64.4	114	9	20	NFS(t)
Orogrande (U)	3.26	1	12.5/54.5	110	16	20	NFS(t)
Osier (L)	4.59	3+j	14/57.2	102	29	55	NFS(t)
Osier (U)	4.59	3+j	11/51.8	104	15	40	NFS(t)
Sugar	4.04	2+j	7/44.6	107	23	35	NFS(t)
Swamp	4.48	3+j	12/53.6	107	19	40	NFS(t)
Sylvan 1997	4.34	5+j	12.5/54.5	106	21	50	NFS(t)
Sylvan 1998	5.68	5+j	10/50.0	99	25	20	NFS(t)
Tamarack	5.07	2+j	13/55.4	103	33	50	NFS(t)
Tumble	5.09	2+j	11/51.8	119	27	25	FS
Sneak	4.36	3+j	14/57.2	105	29	50	NFS(t)

[1] includes fish collection data from BURP and CNF bio-physical studies; +j = including young-of-the-year
[2]CE = cobble embeddedness, taken at the BURP reach
[3]NFS = Not fully supporting, FS = fully supporting, (t) = temperature is cause of not full support, (t&s) = both temperature and sediment are causes for not full support
[4] New data added for this revision

CNF Stream Bio-Physical Studies

Over approximately the last 10 years, the CNF has contracted bio-physical studies of all of 303(d) listed streams in the UNFCRS, except for Deception Gulch. (Note: Since this TMDL was originally written in February 2001, a bio-physical study has been completed of Deception Gulch as well.) The results of these studies are contained in a series of reports identified in the reference section of this document as authored by "Clearwater Biostudies, Inc." or "Isabella Wildlife Works." Each of these studies includes a stream survey of the whole stream divided into numerous reaches, surveys and calculations of substrate embeddedness, riffle stability surveys, fish surveys, and stream flow calculations. The stream surveys included determining Rosgen (1994) channel types and major hydrologic features. They are far more extensive and exhaustive than the BURP data, except that they do not collect and analyze macrobiota other than fish. The "Reach Overview Form" completed by the field crews when conducting these surveys provides valuable insight to the current condition of the streams on a reach-by-reach basis. Physical data from these studies used in this report are presented in Table 7. Table 6 above incorporates the biological results from these studies with respect to the fish present in the streams.

We used the data and conclusions in these reports to help make determinations about water quality status. First, the fish data collected in these surveys have been used to help make the WBAG-based beneficial use support determinations on the 303(d) listed streams. This meets the WBAG plus requirements of using electrofishing data collected either in the process of conducting BURP activities or collected by others in a reliable manner.

Second, we use the bank stability index and the actual measures of the percentage of raw banks in the given stream as measures of channel stability. These are the direct measures we use to assess the listing of Sneak Creek as water quality impaired due to channel instability. In addition we use the bank stability index in our consideration of in-stream erosion as producing sediment that impairs beneficial uses and water quality.

Finally, we considered cobble embeddedness as an indicator of stream sediment accumulation. Cobble embeddedness refers to the percentage of a larger streambed particle's long axis surrounded by particles less than 6.4 millimeters (mm) in size. Some of the bio-physical surveys identify high levels of cobble embeddedness as a factor limiting fish habitat potential on some streams in the subbasin.

Fish Data

Table 6 summarizes the salmonid fish data for the 303(d) listed streams. These data were derived from BURP electrofishing and data collected by the CNF at the fish stations established during the bio-physical surveys. Table 6 notes when young-of-the-year were observed, which is an indicator that successful spawning and rearing occur in the stream. These data and other data not presented here demonstrate that the subbasin water quality provides for protection, maintenance, and propagation of a salmonid fish population.

Table 7. Stream data from CNF-contracted studies of the 303(d) listed water bodies.

	Study Area Length (m)	Average Stream Gradient (%)	Average Cobble Embed.[1] (%)	Bank Stab-ility Index	Raw Banks (m/km)[2]	Per-cent Pools	Per-cent Riffles
China	6,660	3.1	48.3	4.8	64	43.1	32.6
Cold Springs	7,095	11.0	20.8	4.6	88	13.2	67.6
Cool	4,790	14.0	27.2	4.8	48	15.6	67.9
Cougar	4,180	14.0	41.2	5.0	12	23.4	57.6
Deception[3]	7,410[3]	4.7[3]	48.6[3]	4.8[3]	41.9[3]	28.5[3]	49.0[3]
Gravey	15,120	2.6	22.1	4.0	135	32.0	68.0
Grizzly	5,100	15.0	34.6	5.0	10	21.7	54.3
Hem	7,230	5.0	29.2	4.9	21	19.1	67.6
Laundry	6,420	5.5	53.2	4.9	37	30.8	67.5
Marten	7,020	4.2	30.6	4.0	113	46.0	54.0
Middle	25,590	3.8	19.1	4.0	124	42.14	57.9
Orogrande	23,255	1.7	24.5	4.7	73	8.9	55.2
Osier	11,550	3.5	56.0	4.4	62	nd	nd
Sugar	6,205	3.8	64.3	5.0	nd	20.6	33.1
Swamp	11,870	3.9	43.8	4.9	nd	10.5	37.6
Sylvan	7,095	4.9	23.4	5.0	6	19.8	64.3
Tamarack	6,090	7.9	39.6	5.0	6	23.9	61.0
Tumble	7,485	6.2	56.2	5.0	1	46.1	22.6
Sneak	3,695	15.0	33.6	5.0	0	25.3	53.5

[1] Embed. = Embeddedness
[2] m/km = meters per kilometer
[3] New data added for this revision

2.4 Data Gaps

Overall, there are numerous data about water quality in the UNFCRS. However, an abundance of data does not always lead directly to answers. It often leads to more questions. This is the case with the temperature and aquatic life data in the UNFCRS.

Statewide temperature criteria have been established to define when the thermal load results in an environment unsuitable to successful spawning and propagation of various aquatic life species. The assumption has been that when these temperature criteria are exceeded, the water has been polluted and made unsuitable for its designated beneficial uses. In the UNFCRS, we have many in-stream temperature measurements that exceed those criteria, and yet we also have abundant documentation of coincident successful spawning and propagation of the desired cold water aquatic life species. We do not have a data set that helps us identify what is going on in these situations.

The case for sediment in relation to water quality is even murkier. We are fairly certain that turbidity is not exceeding the state standards, although we don't have data on the specific 303(d) streams we think are questionable. The BURP and other snapshot-in time-fish data show that by and large salmonid spawning is being supported as determined by the WBAG process. However, there are water bodies that have received and continue to receive heavy sediment loads. We need a data set that would help determine whether these heavy sediment loads threaten the long-term viability of the salmonid populations. We need to know how much sediment loads can be above background for a given landscape setting that will still allow beneficial uses to be supported over time.

3. Subbasin Assessment – Pollutant Source Inventory

3.1 Sources of Pollutants of Concern

This section lists potential sources of surface water pollutants in the subbasin. The pollutants cited as causing exceedances of water quality standards in the 303(d) listing of subbasin streams are discussed in detail. Pollutant sources may occur as point sources, those for which effluent limitations may be required under sections 301(b)(1)(A) and 301(b)(1)(B) of the CWA, or as non-point sources of pollutants that are not subject to effluent limitations.

Point Sources

There are no known point sources of pollutants within the UNFCRS.

Sediment Non-Point Sources

The data sets discussed in this section are primarily pollutant source data sets, but since they were developed in response to water quality issues and we use them to help us draw conclusions about the water quality status, we present them below. Summaries of the data for the watershed by watershed analyses are presented in Tables 6 through 9. Non-point sources of sediment above natural background in the UNFCRS include forest management activities, fires, roads and trails, recreational activities, mining, landslides, in-stream erosion, other land administrative activities, and airfall. The precise amounts of pollutant contributions from each of these non-point sources to the subbasin are unknown.

The CNF, IDL, and private timber companies conduct forest management activities including road construction, reconstruction, and maintenance; timber thinning, fertilization, and harvesting; and fire suppression that may result in increased erosion and sedimentation. The state and private timberlands are primarily in the upper Orogrande Creek watershed. The remainder of the timber-producing land is managed by the CNF.

Road Data

The UNFCRS has 1,951 miles of roads, virtually all of which are unpaved, and most of which are native surfaced. Figure 10 shows the distribution of these roads in the subbasin. Note the correlation of highly roaded areas with 303(d) listed watersheds. Approximately 622 miles of the roads have some kind of travel restriction, designed at least in part to reduce erosion. Still, even under the best of circumstances, road erosion is known to be the major contributor of sediment to streams in roaded forest systems. Within timber management areas, roads are recognized as the primary source of sediment being delivered to waterways. Roads directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, and riparian conditions in the watershed (USFS 1997). Road-related surface erosion and mass failures can continue for decades after the roads are constructed. Stream crossings can also be major sources of sediment to streams resulting from channel fill around culverts, road surface drainage to crossing areas, and crossing failures (Furniss 1991).

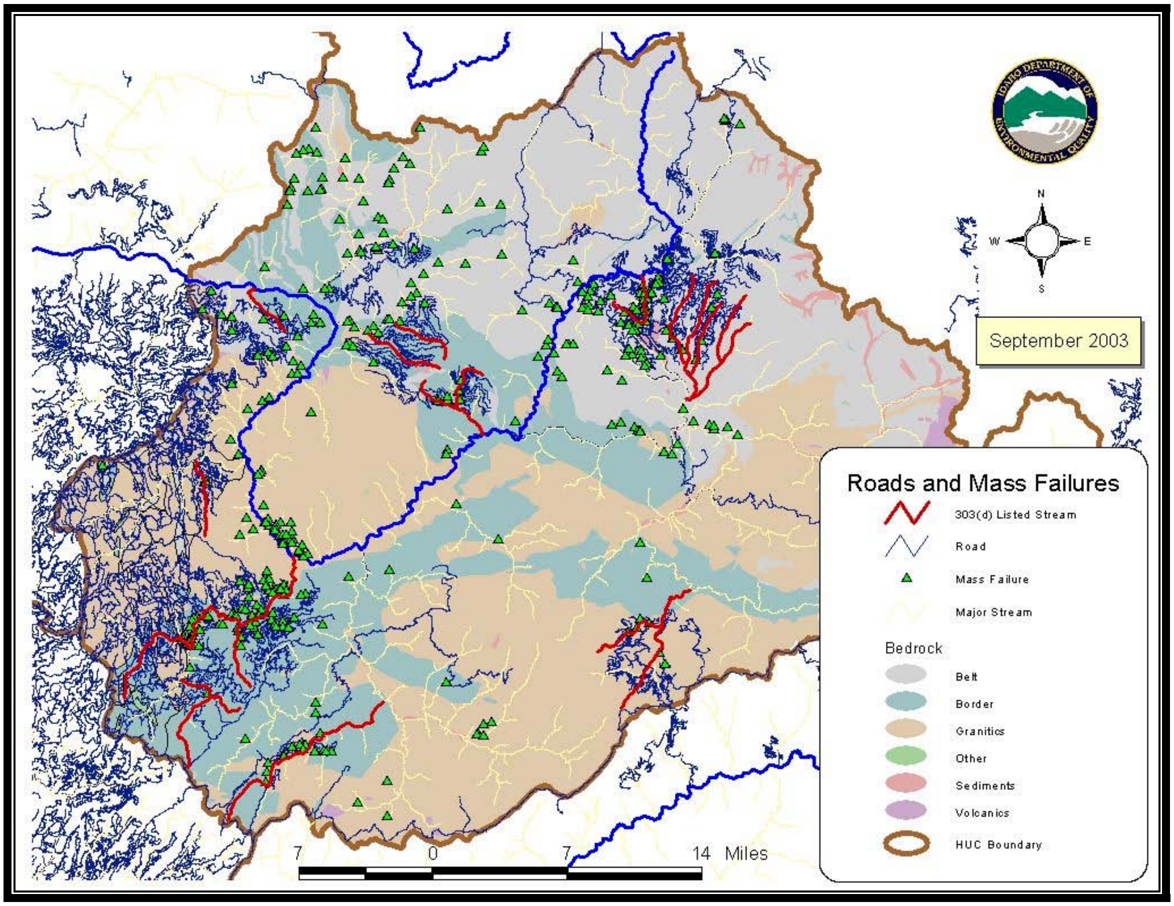

Figure 10. Roads and Mass Failures Related to 303(d) Streams in the UNFCRS

Table 8 shows a tabulation of various statistics related to roads and mass failures. Within the UNFCRS, most road-related sediment is being delivered into waterways from a few situations: roads that are parallel to and within approximately 100 feet of a stream; mass failures from road cut and fill slopes that move all the way down a slope into a stream channel; and stream crossings where road drainage and the associated sediment is dumped directly into the channel. Road density can be used as an indicator of the impact of roads. The USFS identifies greater than 4.7 miles of road per square mile of watershed as a high road density (USFS 1996). Of the streams on the 303(d) list, the China, Cool, Deception, Grizzly, Cougar, Laundry, Orogrande, Osier, Sylvan, Sneak, and Tumble Creek watersheds have greater than 4.7 miles of roads per square mile of watershed. Another indicator of road hazard to water quality is the percentage of roads in landtypes identified as having a high risk for mass failures. Approximately 25 percent of the roads in the UNFCRS are on mass failure sensitive landtypes. Still another indicator is the percentage of roads within 100 feet of a stream. Approximately 18 percent of the roads in the UNFCRS are close to streams. We examined these indicators for each of the 303(d) listed streams.

Table 8. Road and mass failure data for the 303(d) listed water bodies in the UNFCRS.

Water Body[1]	Area	Area	Roads	Road Density[2]	Roads in SPZ[3]	Roads in High Risk Land-types	Number of Mass Failures	Mass Failure Density
	(acres)	(mi^2)	(miles)	(mi/ mi^2)	(%)	(%)		(#/mi^2)
China	2,606	4.1	25	6.1	10	5	1	0.2
Cold Springs	4,041	6.3	23	3.6	13	16	3	0.5
Cool	2,828	4.4	23	5.2	9	28	8	1.8
Cougar	3,232	5.1	24	4.8	6	79	0	0.0
Deception	2,973	4.7	42	9.0	13	50	24	4.9
Gravey	16,254	25.4	75	3.0	12	5	2	0.1
Grizzly	2,771	4.3	25	5.8	5	81	0	0.0
Hem	4,768	7.5	12	2.8	2	38	0	0.0
Laundry	1,845	2.9	22	7.6	11	8	3	1.0
Marten	3,936	6.2	16	2.6	27	2	4	0.7
Middle	17,643	27.6	43	1.6	7	22	14	0.5
Orogrande (L)	11,170	17.5	106	6.1	36	28	51	2.9
Orogrande (U)	19,929	31.1	250[4]	8.1[4]	13[4]	nd[5]	9	0.3
Osier	5,006	7.8	52	6.7	13	13	5	0.6
Sugar	2,411	3.8	9	2.4	7	0	0	0.0
Swamp	7,956	12.4	1	0.1	0	0	0	0.0
Sylvan	3,464	5.4	36	6.7	3	24	1	0.2
Tamarack	3,562	5.6	15	2.7	1	43	5	0.9
Tumble	2,069	3.2	20	6.2	25	0	1	0.3
Sneak	2,488	3.9	19	4.9	15	58	1	0.3

[1] (L) = lower; (U) = upper
[2]Shading identifies data on the high end of the range
[3]Stream Protection Zone
[4]Road data for upper Orogrande are more detailed than for other watersheds.
[5] nd = data not available.

Mass Failure Data

The CNF, IDL, and Potlatch Corporation collaborated in collecting an extensive data set on the mass failures that occurred in the 1995-96 rain-on-snow event. The results of this data collection effort are presented in McClelland et al. (1997). In addition, the locations of the mass failures, and some of the related data, have been entered in a GIS database (Figure 9). We have used that database to stratify and analyze the mass failures on a watershed by watershed basis. These data are presented in Table 8.

Mass failures are an important sediment source in the subbasin. The combination of highly weathered and altered bedrock, steep slopes, substantial road building, fire- and logging-reduced vegetative cover, and rain-on-snow events has resulted in significant landslides. Including and since the 1995-96 rain-on-snow event, 370 landslides have been documented in the UNFCRS (Figure 9). Of these, 130, or about 35 percent, occurred in 303(d) listed watersheds; however, 303(d) listed watersheds comprise only about 13 percent of the acreage in the subbasin.

The USFS has determined that about two-thirds of the mass failures are related to management activities and about one-third are natural (58% are road-related, 12% are associated with timber harvest, and 29% are natural) (McClelland et al. 1997). These findings are similar to those for the major landslide event in 1974, which was also triggered by rain-on-snow, but the more recent event is estimated to have produced twice the sediment volume. Total sediment volume, rather than number of slides, may be more relevant to water quality. The best available estimate is that sediment volume delivered to streams is apportioned as follows: 25 percent from roads, 4 percent from timber harvest areas, and 71 percent from natural landslides. For example, two of the 907 landslides resulting from the 1995-96 rain-on-snow events on the CNF together produced 38 percent of the sediment volume delivered to streams (McClelland et al. 1997). These two slides were concluded to have been natural. One of these, the Quartz Creek slide, occurred in the UNFCRS, albeit on a water body that is not 303(d) listed.

Mining and Other Sediment Sources

Limited placer mining for precious metals and gemstones is conducted at several locations. Small-scale, recreational dredge mining in the Moose Creek and Orogrande Mining Districts may be contributing some sediment. However, most of the sediment being produced in these areas is cobble-sized material as stream channels reestablish their normal meander patterns in the placer-mining debris produced in the last half of the 19th century.

In addition to the known in-stream erosion of placer mining debris in the mining districts, other streams in the subbasin may be producing some sediment through bank erosion and downcutting. Geologic and geomorphic evidence indicates that streams in the UNFCRS are actively downcutting geologically, and as such, should be expected to exhibit a certain amount of in-stream erosion. On the other hand, logging activities, especially road construction and canopy removal, alter the hydrologic balance and may lead to channel instability and erosion. Without getting into a discussion of what might be geologically natural, and what might be management induced, it is noted that CNF data indicate that Cool Creek, Hem Creek, Osier Creek, and Sylvan Creek have some in-stream erosion occurring.

A native-surfaced airplane runway is situated on the divide between Osier Creek and Independence Creek, near Deception Saddle. The airport is on a mining claim patented as private property. While evidence of erosion on the runway is clear, we were not able to track any significant sediment to an active stream channel. It is almost certain that some clay and silt sized material are being transported to active stream channels during spring snowmelt and other periods of high runoff. However, it is doubtful that this runway contributes significant sediment loads to Osier or Independence Creeks.

Recreational activities in the subbasin may contribute to erosion and sedimentation. These activities include picnicking, hiking, camping, hunting, horseback riding, bicycling, using off-road vehicles, fishing, kayaking, canoeing, rafting, swimming, cross country skiing, snowmobiling, and scenery and wildlife viewing. However, field observations indicate that none of these activities are producing any significant sediment in the UNFCRS.

In thinking about non-point source pollutants, one must suppose that some sediment comes from airfall, the effects of fires, and administrative activities in the subbasin (maintaining the USFS Kelly Forks Work Station and fire lookouts, for example). Some of these contributors may be significant on a larger scale, at least at times. However, for the water bodies being assessed in this document, it is concluded that these types of sediment sources are insignificant.

Stone, sand, and gravel are mined for local road construction and surfacing at several sites within the subbasin. While most of these are away from riparian areas and streams and are well designed to reduce sediment moving off the sites, at least one site on Osier Creek was observed that needed improvement.

Grazing activities that may contribute to riparian area denudation and the sediment load within the subbasin are relatively few. They include short-term, site-specific grazing of pack and saddle stock and minor domestic livestock grazing that occurs mostly on private lands in the lower part of the subbasin. Potlatch Corporation and IDL have grazing leases in the upper Orogrande drainage.

In conclusion, only the effects of sediment from roads, mass failures, and in-stream channel erosion are considered significant for this assessment. The effects of sediment from grazing, mining, recreation, administrative activities, and the airport in Osier Creek are observable but much less significant.

Idaho's Cumulative Watershed Effects Process

Cumulative Watershed Effects assessments have been completed for virtually all of the upper Orogrande Creek and French Creek watersheds (the French Creek watershed includes the Hem and Sylvan Creeks watersheds). The CWE process collects and organizes data on mass failure and surface erosion hazards, stream temperature, watershed canopy condition, hydrologic risk, sediment production and delivery to a waterway, stream channel stability, and water nutrient condition. The process relies on the WBAG beneficial use support determination as the measure of whether or not a stream is water quality impaired. The CWE methodology analyzes these data and determines whether forest practices are creating "adverse conditions" due to sediment, temperature, nutrients, and/or hydrologic impacts (IDL 2000).

While CWE adverse conditions are not defined using the state's water quality standards, the intent of the process is to respond to the CWA and devise surrogate measures for when forest practices are significantly impacting water quality. Since CWE is conducted on the ground, in the watershed, the results are a systematic and up-to-date assessment of how forest practices are impacting a watershed and its water quality. If CWE identifies adverse conditions for any of the four pollutants it screens for, then the water body assessors need to look at the situation carefully. Conversely, if CWE concludes that forest practices are not contributing substantially to any of the pollutants under consideration for a watershed, the data are considered reliable indicators of the situation on the ground.

In particular, in this assessment, because most of the streams are 303(d) listed for sediment, we use CWE road sediment delivery scores and the CWE mass failure data where available. Estimated CWE road sediment delivery ratings are presented in Table 9. In watersheds that are temperature limited, we use the CWE stream temperature assessment model where percent shade and elevation predict stream temperature as the indicator of where temperature loading is occurring. By this, we are setting the stage to use this relationship in the TMDL as our measure of whether stream temperature is being reduced in temperature limited streams.

WATBAL Predictions

The CNF uses the WATBAL model to help it allocate resources and make management decisions. In its forest plan, the CNF states its management goal for water quality to "Manage watersheds, soil resources, and streams to maintain high quality water that meets or exceeds State and Federal water quality standards, and to protect all beneficial uses of the water, which include fisheries, water-based recreation, and public water supplies," (USFS 1987). Since, as with CWE, the ultimate goal is to achieve water quality, we use the CNF data in this assessment to help us evaluate whether a given water body is water quality limited.

The WATBAL model was developed to predict the amount of sediment being produced naturally from a given landtype based on a fairly extensive data collection effort on the CNF. Then, as roading, logging, and other management activities take place in a watershed, WATBAL predicts the additional amount of sediment being produced by these activities. These predictions were calibrated against data collected in the late 1970s and 1980s. We use the CNF's WATBAL predictions of percent sediment over background to help identify watersheds that need closer evaluation of their sediment condition. The results are shown in Table 9.

Table 9. WATBAL and CWE results for 303(d) listed streams.

Water Body[1]	Cobble Embeddedness Threshold	Current Sediment (% over background)	CWE Road Sediment Delivery Rating[2]
China	25-30	8	Medium
Cold Springs	25-30	17	nd
Cool	25-30	13	nd
Cougar	30-35	15	nd
Deception	40-45	28	Medium
Gravey (L)	30-35	11	nd
Gravey (U)	30-35	nd	nd
Grizzly	30-35	28	nd
Hem	30-35	5	Low
Laundry	25-30	12	Medium
Marten	30-35	20	nd
Middle	35-40	17	nd
Orogrande (L)	40-45	nd	High
Orogrande (U)	40-45	nd	Low
Osier	25-40	5	Medium
Sugar	30-35	15	Low
Swamp	30-35	0	Low
Sylvan	30-35	14	Low
Tamarack	30-35	40	nd
Tumble	35-40	39	nd
Sneak	25-30	90	Low

[1] (L) = lower; (U) = upper
[2] nd = no data

Heat Non-Point Sources

Osier Creek is the only water body in the UNFCRS that is 303(d) listed for temperature. This means that heat is the pollutant. In our conclusions in this subbasin assessment, we identify several other water bodies where water quality is limited by heat loading. We suspect this is true of many other water bodies in the subbasin, as well. Those other water bodies not included on the current 303(d) list will be evaluated during the development of Idaho's upcoming 303(d) listing cycle and during an assessment of the adequacy of the state's current temperature standard criteria. All the current 303(d) listed water bodies, regardless of the suspected pollutant, are evaluated herein for temperature exceedances.

Additional heat being absorbed by a water body beyond background in forested environments is usually a function of shade reduction. Certainly in the case of Osier Creek, which was heavily logged in the 1960s and 1970s, it is reasonable to think that an additional heat load and, therefore, increased stream temperature, have resulted from decreased stream shading.

One aspect of heat loading is a change in channel morphology such that a channel becomes wider and shallower (higher width to depth ratio), with a resultant increase in surface exposure to solar and long-wave radiation. In most cases within the UNFCRS subbasin, where higher width to depth ratios are thought to have developed as a result of human activity, the altered ratios are primarily the result of road construction or mining alteration of the channel. Less obviously, the change can be the result of removal of streamside vegetation that kept the channel narrow and sinuous.

Another possible contributor to increased stream temperature is altered flow regimes as a result of watershed canopy removal. Some evidence exists that canopy removal over broad sections of a watershed may increase flows in the early part of the season and result in lower flows in the latter part of the season when air temperatures are highest. Other evidence exists, in watersheds with deep, permeable vadose zones and vegetative covers with large evapotranspiration potentials, that canopy removal may result in increased flows throughout the year. In the case of lower volume flows, one might expect a greater temperature increase for a given amount of heat loading. The CNF notes that its data for the UNFCRS on increasing or decreasing stream flow due to canopy changes is inconclusive.

We do not address this situation herein because flow modification is not a pollutant under the CWA. The loading of heat as a pollutant in both scenarios is roughly equivalent, given similar channel and habitat conditions. Higher early season flows could possibly result in channel widening (and subsequent increased heat loading), but we do not see evidence for this in the channel stability data in this subbasin. We point out the possible flow modification situations for the benefit of land managers who will be developing management strategies to reduce stream temperatures as a result of the TMDLs included in this document: increasing late season flows for a given heat load might be a good strategy for reducing stream temperatures.

An outstanding question at this point is whether additional heat loading as a result of logging and road building is causing water quality numeric criteria exceedances in other water bodies of the UNFCRS. Also outstanding is the question of which streams do or would exceed the Idaho and federal water quality numeric criteria in the absence of logging related shade reduction.

3.2 Data Gaps

This section discusses where additional data could help clarify questions about water pollution and how to maintain water in the subbasin so it meets state water quality standards. While considerable data are available such that water quality can be assessed with a reasonable degree of certainty, better and more specific data would certainly be helpful.

One of the biggest questions regarding water quality in the UNFCRS has to do with heat as a pollutant and to what degree water temperature might be limiting the beneficial uses of a given water body. It is known at this point that summer stream temperatures for many streams in the UNFCRS exceed the state water quality standards for salmonid spawning. A question beyond the scope of the UNFCRS problem assessment is whether the state temperature standards (including the methods for measuring stream temperature) are correct for the designated beneficial uses. What we do know is that we have stream temperature data collected using the standard methodology that indicate water pollution according to the state water quality standards, yet we also have what appear to be healthy, reproducing populations of sensitive salmonids such as westslope cutthroat trout. We need some other data that will help rectify the discrepancy between these two data sets.

The extent to which riparian timber harvest has altered streamside shading and channel morphology is not known. We do not have historic records that show how much shading existed before logging began, nor what the channels looked like. Therefore, we don’t have a very accurate picture of what really is human-caused heat loading and what is natural. The same can be said for the effects of mining on shading. We also do not have much of an idea of what long-term effects the large fires during the first half of the twentieth century had on shading.

We do not have good data about the exact sources and amount of sediment from roads and its percent delivery. Since mass failures are episodic, our relatively limited data do not provide enough information for a good understanding of how mass failures are distributed through time.

We have very little data about sediment from modern or historic mining. The majority of mining alteration of the landscape occurred before passage of the CWA, so likely is outside the scope of this legislation. Modern day mining operations are regulated and appear to be having a minimal impact, but no data are available.

We have very little data on the sediment condition of streams before the early 20th century fires or the large 1975-76 rain-on-snow event. We have WATBAL predictions, but we really don’t know what the baseline condition is for sediment in different streams on different landtypes. The data for WATBAL validation were collected after these events.

We lack reliable data on the extent and cause of bull trout declines in this subbasin. We do not have information to help us sort out what part of the decline is due to habitat factors or food chain factors and what part might be the result of heat or sediment pollution.

Modeling efforts would be greatly improved if we had accurate and consistent GIS layers. We do not have accurate topographic layers to be able to identify all potential waterways. We do not have good layers for riparian and streamside zones, other than some coarse buffers. Even though we know that much sediment is being delivered from roads directly to waterways, the GIS layers do not accurately depict the situation on the ground for lack of good road and stream channel layers. Data on road type, size, condition, maintenance, culverts, and drainage location in a GIS format would be invaluable.